LEVEL II

INTERIM TECHNICAL REPORT TR 81-2328-2

THE DESIGN OF A MULTI-MEDIA MAP-STORE/SURROGATE TRAVEL INFORMATION SYSTEM

DECISIONS AND DESIGNS INCORPORATED

Robert M. Pitkin
Dennis R. Buede
John F. Anderson

May 1981

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THE DESIGN OF A MULTI-MEDIA MAP-STORE/SURROGATE TRAVEL INFORMATION SYSTEM

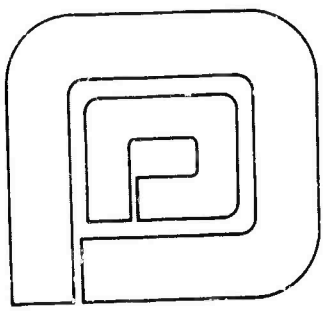
by

Robert N. Kraft, Dennis M. Buede, and John F. Patterson

Sponsored by

Defense Advanced Research Projects Agency
Contract MDA 903-81-C-0192
DARPA Order No. 4090

May 1981



DECISIONS and DESIGNS, INC.
Suite 600, 8400 Westpark Drive
P. O. Box 907
McLean, Virginia 22101
(703) 821-2828

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: TR-81-2-328.23	2. GOVT ACCESSION NO.: AD-A099 402
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): THE DESIGN OF A MULTIMEDIA MAP-STORE/SURROGATE TRAVEL INFORMATION SYSTEM.	5. TYPE OF REPORT & PERIOD COVERED: Technical Report.
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Robert N. Kraft, Dennis M. Buede, John F. Patterson	8. CONTRACT OR GRANT NUMBER(s): MDA903-81-C-0192, DARPA Order No. 4090
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Decisions and Designs, Inc. Suite 600, 8400 Westpark Drive, P.O. Box 907 McLean, VA 22101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: DARPA Order No. 4090
11. CONTROLLING OFFICE NAME AND ADDRESS: Defense Advanced Research Projects Agency (DARPA) DSO/CTD, 1400 Wilson Boulevard Arlington, VA 22209	12. REPORT DATE: May 1981
	13. NUMBER OF PAGES: 84
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Mapping	Photography	Computer-aided analysis
Cartography	Resource allocation	Information retrieval systems
Computer mapping	Cost/benefit analysis	Travel information system
Maps	Videodisc	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the effort to design the software and hardware capabilities of a videodisc mapping and surrogate travel system and to select the various sites to be incorporated into this system. Experts from DARPA's Cybernetics Technology Division and from Interactive Television Corporation (ITC) worked with decision analysts from Decisions and Designs, Inc. (DDI) to extend and elaborate the electronic surrogate travel concept previously developed and demonstrated by DARPA. The general problem was to develop a simple yet innovative conceptual design for a map-store/surrogate travel information system.

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Such a system must be capable of storing, indexing, and retrieving a wide range of visual and linguistic data, such as maps; aerial, attache, and underwater photography; sequences of shots for surrogate travel; plans and blueprints of key installations; instructional manuals; movies; critical auditory information; panoramas; piloting charts of coasts and harbors; and specialized chart maps indicating the distribution of population, industry, wealth, and vegetation, among others.

Design of the map-store/surrogate travel system and selection of the sites was accomplished through a sequence of three one-day working sessions. The first two sessions were devoted to developing a full range of feasible software and hardware options for the system; developing a set of criteria to determine the sources and kinds of data to be included in the system; and enhancing the man-machine interaction and demonstrability of the system. The third session discussed potential sites and later established a set of preferred sites and options, given fiscal constraints. The methodology used during these working sessions is described in detail in the text along with the design of the map-store/surrogate travel information system and the results of the site selection process.

CONTENTS

FIGURES

TABLES

THE DESIGN OF A MULTIMEDIA MAP-STORE/ SURROGATE TRAVEL INFORMATION SYSTEM

1.0 INTRODUCTION

This document describes the effort to design the software and hardware capabilities of a videodisc mapping and surrogate travel system and to select the various sites to be incorporated into this system. Experts from the Cybernetics Technology Division of the Defense Advanced Research Agency (DARPA) and from Interactive Television Company (ITC) worked with decision analysts from Decisions and Designs, Incorporated (DDI) to extend and elaborate the electronic surrogate travel concept previously developed and demonstrated by DARPA. The general problem was to develop a simple yet innovative conceptual design for a compelling, pedagogically effective map-store/ surrogate travel information system. Such a system must be capable of storing, indexing, and retrieving a wide range of visual and linguistic data, such as maps (topographic, road, atlas, etc.); aerial photography; attache photography; sequences of shots for surrogate travel; plans and blueprints of key installations; instructional manuals; movies; critical auditory information; panoramas; piloting charts of coasts and harbors; specialized chart maps indicating the distribution of population, industry, wealth, and vegetation; underwater photography; and so on.

Design of the map-store/surrogate travel system and selection of the sites was accomplished through a sequence of three separate one-day working sessions. The first two sessions were devoted to the following issues: 1) developing, describing, and codifying the full range of feasible software and hardware

options for the system; 2) developing a set of criteria for deciding upon the sources and kinds of data to include; and 3) enhancing the man-machine interaction and demonstrability of the system. The third working session was devoted to: 1) describing the potential sites and the corresponding levels of effort at each site; and 2) detailing a set of preferred sites and options, given fiscal constraints. A fourth working session to integrate the various software and hardware options with the set of preferred sites was not held.

The remainder of this document describes, in more detail, the methodology used to address the critical issues and the results of the various working sessions. Section 2.0 presents a general description of the methodology, and Section 3.0 presents the design of the map-store/surrogate travel information system and the results of the site selection process.

2.0 THE DESIGN METHODOLOGY

2.1 Model Structure and Use

The resource allocation method that DDI employed for this work is called "Design." A Design model consists of variables, each of which competes with others for limited resources. Each competing variable is itself defined in terms of "levels" that describe increasingly costly options for it. And, each level is described quantitatively in terms of resource requirements (costs) and benefits relative to other levels. A fully defined collection of Design variables that compete for the same resource is called a Design "model." Any given resource allocation decision--that is, any choice of one level for each variable in the model--is called a "package" or "allocation."

In terms of these definitions, the Design methodology and software perform several functions during DDI's working sessions with its clients:

1. to organize, display, and update the working group's judgments about the relative costs and benefits of each level of each variable in the model;

2. to display the relative overall cost and benefit of any one package compared to other packages;

3. to compute and display an approximation to the "efficient-frontier" of packages for the model, (i.e., those key packages among all possible packages that provide maximum benefit for the amount of resource they use); these packages are the key

options for the group to consider, but they are difficult to find without the computer's assistance;

4. to display the variables and levels that comprise the best packages for any given level of overall resource expenditure;

5. to compare different packages proposed by the decision makers with more efficient packages that either cost less and provide the same overall benefit or provide more benefit for the same cost;

6. to perform sensitivity analyses showing the decision makers how the overall results would change as a result of modifying the benefits and costs assigned to the levels on the variables in the Design model.

Design is not an approach that DDI uses to study and recommend decisions; rather, it is oriented towards the collection and use of the high-level professional judgments of the client. This technical approach brings forth the decision makers' expertise and priorities, thereby influencing their decision in an effective and efficient manner. It captures the essence of the working group's collective judgment about resource allocation opportunities, helping it find the most attractive ones.

2.2 Procedural Steps

The implementation of DDI's resource allocation approach using the Design software requires the seven steps described below.

1. Identify variables to which resources can be allocated - Variables over which resources must be distributed are identified. An attempt is made to characterize the problem by using variables that can be independently manipulated. That is, differing levels of resources can be allocated independently to each of the variables.

2. Identify levels of the variables that vary from "austere" to "gold plated" - The "austere" level involves a minimal resource allocation with minimal benefit. The "gold plated" level involves maximal resource allocation and, it would be hoped, maximal benefit. The levels of the variables from austere to gold involve increasing commitments of resources, which usually result in an increased level of benefit to the organization.

3. Assess costs - In the Design software, there is one type of limited resource to be allocated to the variables; this resource is called "cost." A cost is assigned to each level of each variable such that the first level is the least expensive level, successive levels are increasingly more expensive, and the last level is the most expensive level on that variable.

4. Assess benefits (intra-variable) - The levels of each variable are assigned scores to reflect thei relative benefit. Since incremental benefit s being considered, the minimum level is assigned a score of 0 and the highest level is assigned a score of 100. Intermediate levels are assigned values by comparing their improvement over the minimum level

relative to the total improvement from the minimum to the highest level.

5. Assess importance weights (inter-variable benefits) - The variables are given importance weights by having the decision maker(s) assess the relative improvement or benefit of going from austere to gold on each of the variables. This step rescales the 100-point benefit ranges associated with each variable onto a common benefit scale by direct comparison of the benefits associated with these 100-point ranges. For example, one variable may be assessed to have 200 points associated with its austere-to-gold range, while another variable has 100 points associated with its austere-to-gold range. This indicates that the increase in benefit from austere to gold for the former variable is twice as great as the improvement for the latter. The calculated relative benefit value for any level of a variable is proportional to the weight of the variable multiplied by the score on that leve

6. Identify the most cost-beneficial allocations of resources - The set of most cost-beneficial (or cost-efficient) allocations of resources is identified by using the costs and benefits already assessed. These allocations (or efficient packages) form a set that has the property that any allocation not in the set is inferior either in a cost or a benefit sense (or both) to at least one allocation in the set.

7. Exercise the model Proposed allocations are compared to the set of optimal allocations. Sensitivity of allocations to model inputs are examined until

the experts involved are satisfied with the model inputs and the resultant model allocations.

When there are too many variables to be considered in one model, the Design software can be used to reduce the effective number of variables that the group must consider simultaneously. This reduction is accomplished by creating, through a four-step process, a hierarchical Design model composed of independent submodels: (1) the variables are divided into submodels; (2) each submodel is developed and analyzed separately to determine its set of efficient packages; (3) a new variable is created to represent each submodel, with a representative few of the submodel's efficient packages chosen to be levels for the new variable; and (4) the new variables representing the submodels are analyzed together to determine a composite set of efficient packages for the whole model. This four-step process has the advantage in practice of bringing the size of the allocation problem down to a manageable level.

3.0 DESIGN OF THE MAP-STORE/ SURROGATE TRAVEL INFORMATION SYSTEM

3.1 General Overview: Benefit Assessment

In the course of three working sessions, four separate design models were built which described the architecture of the map-store/surrogate travel information system and its implementation. In all four models, the relative benefit of the various design variables were evaluated with respect to two general criteria: (1) value to the user; and (2) demonstrability. In the working sessions, these two benefit criteria were referred to as "user" and "sizzle," respectively. In general, the user benefit of a particular design option refers to the utility of that option for the person in the field, either for training purposes or for operational purposes. Sizzle generally refers to those features of the system which would generate a successful and compelling demonstration by presenting vivid, realistic layouts or by providing information normally not accessible in the field or through dramatic changes in the visual display

Some design variables yielded a high correlation between user and sizzle benefits whereas others, such as "microfiche access," yielded a large negative correlation. Thus, it was necessary to consider both benefit criteria in evaluating the various design models. Further, because there was no rationale for considering one benefit criterion to be significantly more important than the other, the design models were primarily evaluated with equal weightings on user and sizzle benefits.

3.2 Software and Hardware Capability

To design the software and hardware for the information system, three separate design models were built--two software models and one hardware model. The first software model described the variables and the corresponding levels of effort involved in modeling Surrogate Travel. The structure of the Surrogate Travel model is presented in Figure 3-1. Descriptions of the variables, rationale for the benefit values and costs assigned to these variables, and a summary table of these benefits and costs are given in Appendix A. (Note that the benefits and costs are normalized to sum to 1,000.) In general, this model described the eleven variables associated with Surrogate Travel, each of which, when fully or partially instantiated, would significantly alter the present, basic capability and would markedly impact the nature of the software.

The second software design model described the eight variables specifically involved in data manipulation. This model is presented in Figure 3-2. The Data model was primarily concerned with assessing different types of data--microfiche, sound, surrogate travel, maps--and elaborations of the visual display--overlays, digital information, and special effects. Descriptions of the eight Data variables, rationale for the benefits and costs associated with these variables, and the normalized benefits and costs are given in Appendix B.

The hardware model, Delivery System, is shown in Figure 3-3. The twelve variables involved in this structure are relatively self-explanatory, however, additional descriptions and rationale are presented in Appendix C, along with the normalized benefits and costs.

VARIABLE	1	2	3	4
1 CURRENT CAPABILITY	NO IMPROVEMEN	TWIRLS	BACK AROUND COR	
2 TAKE ME THERE	NO CAPABILITY	EMBEDDED OPTION	SEVERAL USER OPTIO	
3 TRACE A PATH	NO CAPABILITY	SHOW ME ALL		
4 PUT ME THERE	NO CAPABILITY	SYMBOLIC	POINT AT	
5 ATTACHE MODE	MINIMAL(NO GRAPHICS)	GRPH IDX OF FIX LOC	GPH DSP OF P FOV/LOC	TOUCH AND SEE
6 HELO FLIGHT	Y TRAVEL	X-Y TRAVEL	X-Y-Z TRAVEL	
7 WHAT'S HERE FDBACK	EXPLICIT LNKS(BOXES	2ND DSPLY GRAPHICS	INTGRT INTO 1ST D	
8 PARALLEL UNIVERSES	EXPLICIT LINK	ATTRIBUTE OF DATA BS		
9 WHERE AM I?	PGMATIC LINE DRAWI	GRPHIC LO-RES B+W	GRPHIC HI-RES B+W	+COLOR
10 RECORD/REPLAY	NONE	YES		
11 UNDERWATER	NONE	ORIENTA-TION AIDS		

MODEL STRUCTURE

Figure 3-1

SURROGATE TRAVEL

VARIABLE	1	2	3	4
1 MAPPING	BK TO STRT/FLYAB	MAP TO MAP	GLOBAL FLYABOUT	
2 MAP TO DATA	NONE	GEOGRAPHIC REFERENCE	CONTEXT REFERENCE	
3 SPECIAL EFFECTS	NONE	INSERTS/FADING		
4 OVERLAYS	NONE	SIMPLE ALPHANUMER	LIMITED GRAPHICS	ELABORATE GRAPHICS
5 SDMS ACCESS TO ST	NO	WINDOW		
6 UPDATING DIGITAL INFO	OFF-LINE	INTERACTIVE ON-LINE		
7 MICROFICHE ACCESS	NONE	INDEP OF VISUAL DAT	INTGRTD INTO VS DA	
8 SOUND ACCESS	WITH MOVIES	SOUND ANNOTATED		

MODEL STRUCTURE

Figure 3-2

DATA

VARIABLE	1	2	3	4	5
1 NUMBER OF MONITORS	TWO,LO-RES COLOR+BW	TWO,HI-RES COLOR+BW			
2 HARD COPY	NONE	+TEXT	+DIGITAL GRAPHICS	B+W VIDEO	
3 TELECONFERENCING	NONE	+LINKING	+POINTING	+ANNOTATION	
4 PACKAGING	NONE	WHEELED METAL BOX	WHEELED METAL CONS	FURNITURE	
5 NO. OF VD PLYRS/SYS	ONE	TWO	THREE	SIX	
6 MASS STORE + COMPUTR	2 MBYTES FLOPPY	4 MBYTES FLOPPY	11 MBYTES HARD		
7 MICROFICHE SYSTEM	NONE	LOW CAPACITY	LO CAP/HARD C	HI CAP/HARD C	
8 POWER CONVERTERS	NONE	1 CONVERTER	2 CONVERTERS	1 INVERTER	
9 TEMPEST	NO	AVAILABLE SYSTEMS			
10 GRAPHIC OVERLAYS	NO	CAP. FOR COLOR MONT			
11 INTERACTIVE MEANS	JOYSTK + 4 BUTTONS	JOYSTK + 6 BUTTONS	OPTION 2 + LIGHT PEN	JOYSTK + SPL FN KYB	OPTION 1 + TOUCHSCRN
12 REMOTE SYSTEM ACCESS	NONE	AS TERMINAL			

MODEL STRUCTURE

Figure 3-3

DELIVERY SYSTEM

After equal wieghts were assigned to user and sizzle benefits, a set of efficient packages was obtained for each of the three models. The three plots are shown in Figures 3-4 through 3-6. Descriptions of these efficient packages are presented in Tables 3-1 through 3-3.

3.3 Site Selection

Prior to designing the model for site selection, it was determined that a total of six different sites would be filmed and recorded in the map-store/surrogate travel information system. It was the responsibility of the participants in the site selection working session, then, to choose the specific sites and the level of effort at each site. The complete design model constructed in this working session is shown in Figure 3-7.

As with the software/hardware models, the sites were evaluated with respect to two benefit criteria--user and sizzle. User benefit generally took into account generality of interest, the potential for establishing operational requirements, national security value, and level of user. Sizzle benefit generally reflected how exotic or unfamiliar the sites were and the potential for demonstrating the full range of surrogate travel/data capabilities.

Judgments concerning relative costs took into account four general characteristics of the sites: (1) overseas versus CONUS; (2) buildings versus streets; (3) the extent of surrogate travel; and (4) the extent of existing photography (attache). After relative cost assessments were made for all twelve site variables, a real-dollar cost was assigned to a single site variable, and the relative cost assessments were then used to assign real-dollar costs to the other eleven

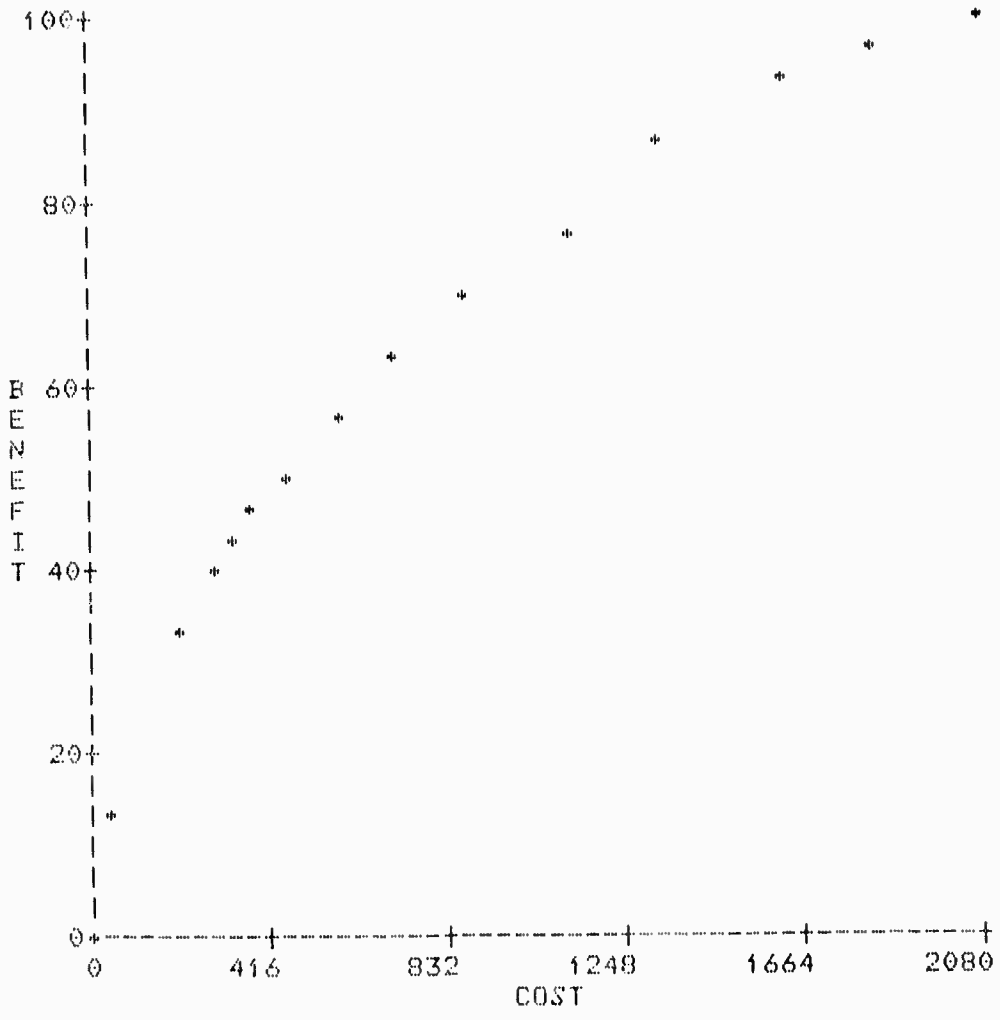

Figure 3-4

PLOT OF EFFICIENT PACKAGES IN
THE SURROGATE TRAVEL MODEL

ALL VARIABLES SET AT LEVEL 1

BENEFIT	COST
0	0

CHANGE 6: HELO FLIGHT
FROM 1: Y TRAVEL
TO 2: X-Y TRAVEL

BENEFIT	COST
131	40

CHANGE 9: WHERE AM I?
FROM 1: PGMATIC LINE DRAWING
TO 3: GRPHIC HI-RES B+W

BENEFIT	COST
324	203

CHANGE 9: WHERE AM I?
FROM 3 GRPHIC HI-RES B+W
TO 4: +COLOR

BENEFIT	COST
434	330

CHANGE 7 WHAT'S HERE FDBACK
FROM 1 EXPLICIT LNKS(BOXES)
TO 2. 2ND DSPLY GRAPHICS

BENEFIT	COST
503	441

CHANGE 7. WHAT'S HERE FDBACK
FROM 2 2ND DSPLY GRAPHICS
TO 3. INTGRT INTO 1ST DISP

BENEFIT	COST
632	705

CHANGE 4: PUT ME THERE
FROM 1: NO CAPABILITY
TO 3: POINT AT

BENEFIT	COST
781	1105

CHANGE 2: TAKE ME THERE
FROM 1 NO CAPABILITY
TO 3 SEVERAL USER OPTIONS

BENEFIT	COST
946	1630

CHANGE 10: RECORD/REPLAY
FROM 1: NONE
TO 2: YES

BENEFIT	COST
1000	2080

CHANGE 1: CURRENT CAPABILITY
FROM 1: NO IMPROVEMENTS
TO 2. TWIRLS

BENEFIT	COST
14	3

CHANGE 1: CURRENT CAPABILITY
FROM 2: TWIRLS
TO 3: BACK AROUND CORNERS

BENEFIT	COST
138	43

CHANGE 6: HELO FLIGHT
FROM 2: X-Y TRAVEL
TO 3 X-Y-Z TRAVEL

BENEFIT	COST
402	290

CHANGE 5: ATTACHE MODE
FROM 1. MINIMAL(NO GRAPHICS)
TO 2. GRPH IDX OF PIX LOC

BENEFIT	COST
468	380

CHANGE 8 PARALLEL UNIVERSES
FROM 1 EXPLICIT LINK
TO 2. ATTRIBUTE OF DATA BS

BENEFIT	COST
580	591

CHANGE 11: UNDERWATER
FROM 1: NONE
TO 2. ORIENTA- TION AIDS

BENEFIT	COST
689	855

CHANGE 3: TRACE A PATH
FROM 1: NO CAPABILITY
TO 2: SHOW ME ALL

BENEFIT	COST
864	1330

CHANGE 5 ATTACHE MODE
FROM 2: GRPH IDX OF PIX LOC
TO 4: TOUCH AND SEE

BENEFIT	COST
979	1830

Table 3-1

DESCRIPTIONS OF THE EFFICIENT PACKAGES FOR
THE SURROGATE TRAVEL MODEL

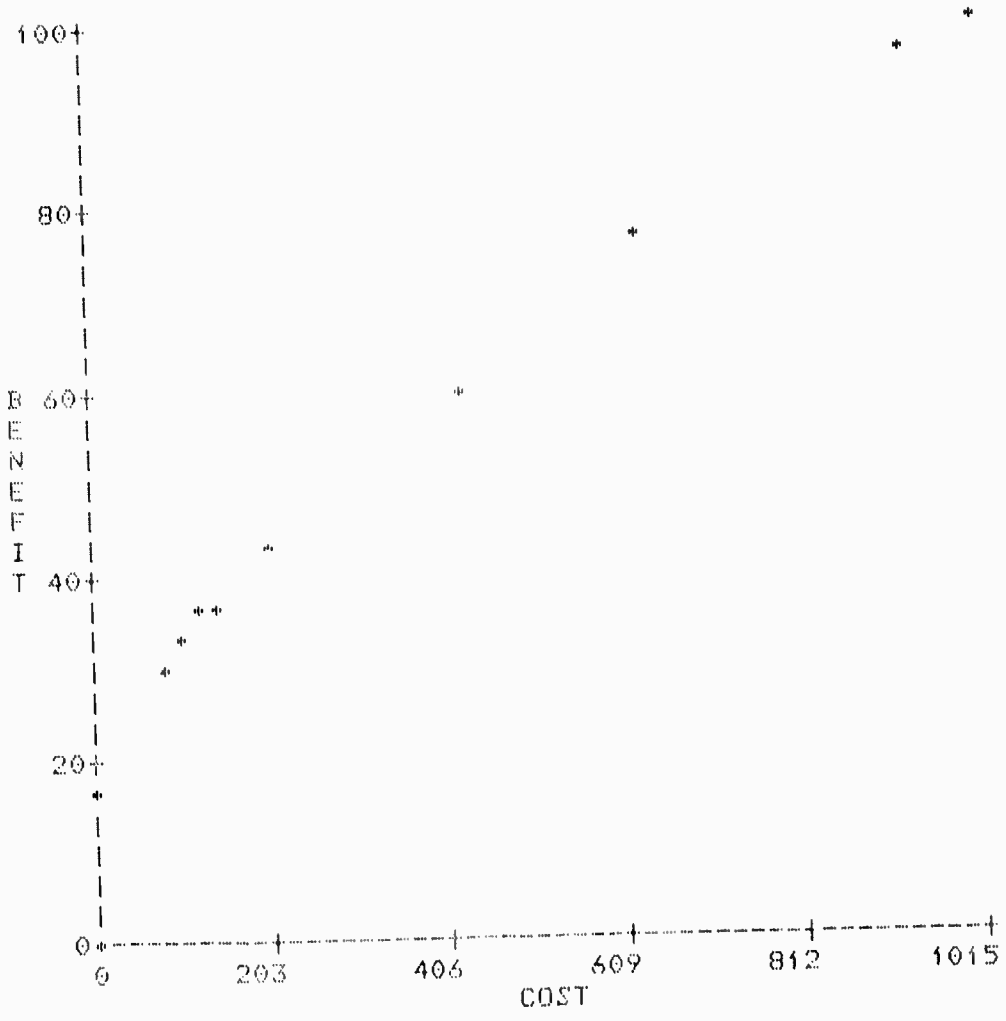

Figure 3-5

PLOT OF THE EFFICIENT PACKAGES IN THE DATA MODEL

ALL VARIABLES SET AT LEVEL 1

BENEFIT	COST
0	0

CHANGE 4: OVERLAYS
FROM 1: NONE
TO 3: LIMITED GRAPHICS

BENEFIT	COST
305	82

CHANGE 7: MICROFICHE ACCESS
FROM 2: INDEP OF VISUAL DATA
TO 3: INTGRTD INTO VS DATA

BENEFIT	COST
351	120

CHANGE 5: SDMS ACCESS TO ST
FROM 1: NO
TO 2: WINDOW

BENEFIT	COST
425	200

CHANGE 1: MAPPING
FROM 1: BK TO STRT/FLYABT/ZM
TO 3: GLOBAL FLYABOUT

BENEFIT	COST
751	635

CHANGE 4: OVERLAYS
FROM 3: LIMITED GRAPHICS
TO 4: ELABORATE GRAPHICS

BENEFIT	COST
1000	1015

CHANGE 7: MICROFICHE ACCESS
FROM 1: NONE
TO 2: INDEP OF VISUAL DATA

BENEFIT	COST
183	2

CHANGE 3: SPECIAL EFFECTS
FROM 1: NONE
TO 2: INSERTS/FADING

BENEFIT	COST
331	102

CHANGE 8: SOUND ACCESS
FROM 1: WITH MOVIES
TO 2: SOUND ANNOTATED DATA

BENEFIT	COST
382	150

CHANGE 6: UPDATING DIGTAL INFO
FROM 1: OFF-LINE
TO 2: INTERACTIVE ON-LINE

BENEFIT	COST
606	435

CHANGE 2: MAP TO DATA
FROM 1: NONE
TO 3: CONTEXT REFERENCE

BENEFIT	COST
959	935

Table 3-2

DESCRIPTIONS OF THE EFFICIENT PACKAGES
FOR THE DATA MODEL

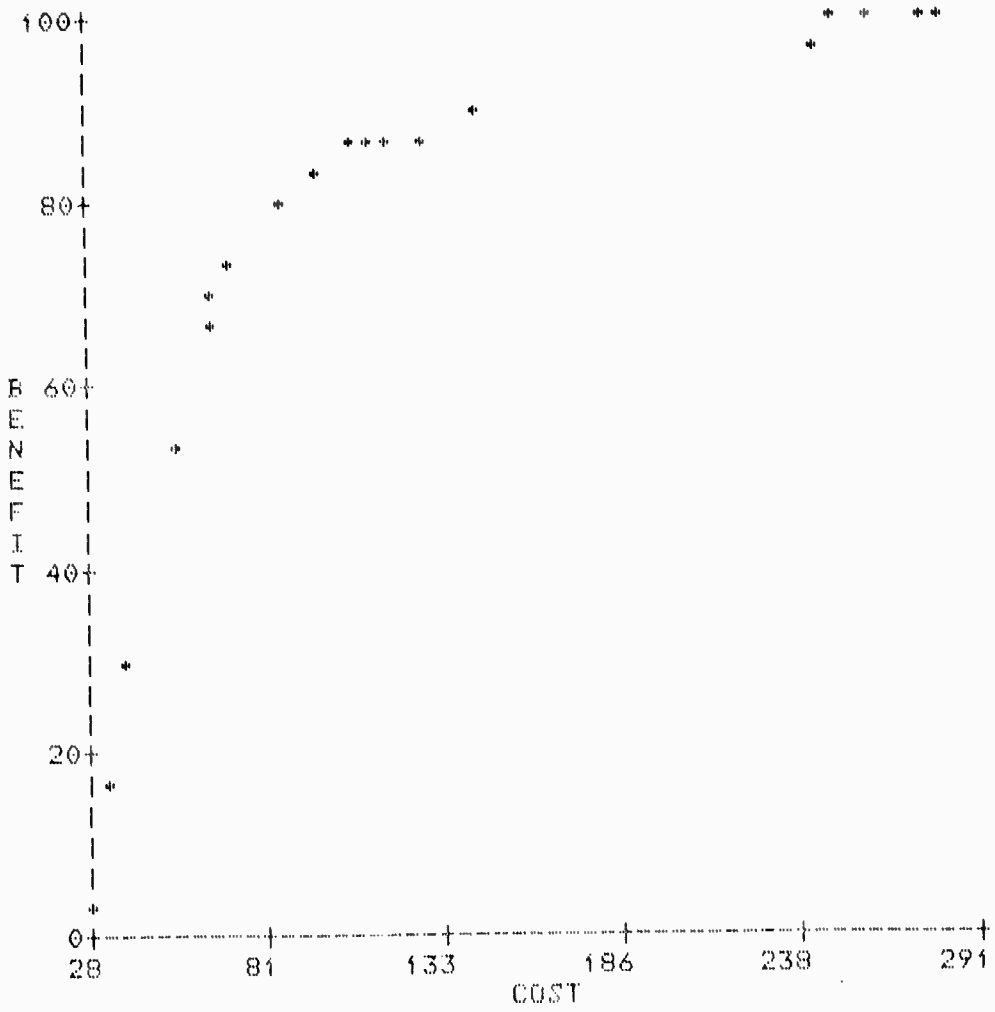

Figure 3-6

PLOT OF THE EFFICIENT PACKAGES
IN THE DELIVERY SYSTEM MODEL

ALL VARIABLES SET AT LEVEL 1

BENEFIT	COST
22	28

CHANGE 8: POWER CONVERTERS
FROM 1: NONE
TO 2: 1 CONVERTER

BENEFIT	COST
174	33

CHANGE 7: MICROFICHE SYSTEM
FROM 1: NONE
TO 3: LO CAP/HARD COPY

BENEFIT	COST
534	55

CHANGE 4: PACKAGING
FROM 1: NONE
TO 2: WHEELED METAL BOX

BENEFIT	COST
692	67

CHANGE 2: HARD COPY
FROM 2: +TEXT
TO 3: +DIGITAL GRAPHICS

BENEFIT	COST
734	71

CHANGE 2: HARD COPY
FROM 3: +DIGITAL GRAPHICS
TO 4: B+W VIDEO

BENEFIT	COST
825	95

CHANGE 7: MICROFICHE SYSTEM
FROM 3: LO CAP/HARD COPY
TO 4: HI CAP/HARD COPY

BENEFIT	COST
854	108

CHANGE 11: INTERACTIVE MEANS
FROM 2: JOYSTK + 6 BUTTONS
TO 3: OPTION 2 + LIGHT PEN

BENEFIT	COST
863	113

CHANGE 1: NUMBER OF MONITORS
FROM 1: TWO,LO-RES COLOR+BW
TO 2: TWO,HI-RES COLOR+BW

BENEFIT	COST
156	32

CHANGE 5: NO. OF VD PLYRS/SYS
FROM 1: ONE
TO 2: TWO

BENEFIT	COST
294	40

CHANGE 10: GRAPHIC OVERLAYS
FROM 1: NO
TO 2: CAP. FOR COLOR MONTR

BENEFIT	COST
668	65

CHANGE 2: HARD COPY
FROM 1: NONE
TO 2: +TEXT

BENEFIT	COST
727	70

CHANGE 6: MASS STORE + COMPUTR
FROM 1: 2 MBYTES FLOPPY
TO 3: 11 MBYTES HARD

BENEFIT	COST
796	85

CHANGE 8: POWER CONVERTERS
FROM 2: 1 CONVERTER
TO 3: 2 CONVERTERS

BENEFIT	COST
828	96

CHANGE 11: INTERACTIVE MEANS
FROM 1: JOYSTK + 4 BUTTONS
TO 2: JOYSTK + 6 BUTTONS

BENEFIT	COST
859	110

CHANGE 3: TELECONFERENCING
FROM 1: NONE
TO 2: +LINKING

BENEFIT	COST
871	119

Table 3-3

DESCRIPTIONS OF THE EFFICIENT PACKAGES FOR THE DELIVERY SYSTEM MODEL

CHANGE 5: NO. OF VD PLYRS/SYS
FROM 2: TWO
TO 3: THREE

BENEFIT	COST
878	126

CHANGE 11: INTERACTIVE MEANS
FROM 3: OPTION 2 + LIGHT PEN
TO 5: OPTION 1 + TOUCHSCRN

BENEFIT	COST
894	144

CHANGE 12: REMOTE SYSTEM ACCESS
FROM 1: NONE
TO 2: AS TERMINAL

BENEFIT	COST
987	249

CHANGE 5: NO. OF VD PLYRS/SYS
FROM 3: THREE
TO 4: SIX

BENEFIT	COST
999	277

CHANGE 4: PACKAGING
FROM 2: WHEELED METAL BOX
TO 3: WHEELED METAL CONSOL

BENEFIT	COST
880	129

CHANGE 9: TEMPEST
FROM 1: NO
TO 2: AVAILABLE SYSTEMS

BENEFIT	COST
983	244

CHANGE 8: POWER CONVERTERS
FROM 3: 2 CONVERTERS
TO 4: 1 INVERTER

BENEFIT	COST
992	257

CHANGE 3: TELECONFERENCING
FROM 2: +LINKING
TO 4: +ANNOTATION

BENEFIT	COST
1000	281

Table 3-3 (Continued)

DESCRIPTIONS OF THE EFFICIENT PACKAGES FOR THE DELIVERY SYSTEM MODEL

VARIABLE	1	2	3	4	5
1 DOE NUCLEAR REACTOR	NONE	GROUND (INT + EXT	+ CONVENTION	+ LOW LEVEL HELO	+ ANCILLARY
2 OLYMPIC SITE--LA	NONE	GRND(INT/EXT TCTCL)	+ LOW LEVEL HELO	+ ANCILLARY	
3 FULDA GAP	NONE	MAPS	+ ATTACHE PHOTOG.	+ ANCILLARY	
4 CIA CITY	NONE	CIA PHOTO + MAPS	+ ANCILLARY	+ TOURIST PHOTOG.	
5 29 PALMS/USMC	GRND/HELO(USMC)	PROF. FILM CREW	+MAR EXRCSE,DEL	+MAR EXRCSE,REM	
6 USMC-5 OMAN SITES	NONE	HELO OFLY + REF MAP	+ LIMTD GRND DATA	DETAILED GRND,1 SIT	
7 USMC-EGYPT,KENYA,SOM	NONE	HELO OFLY + REF MAP	+ LIMTD GRND DATA	DETAILED GRND,1 SIT	
8 USMC-DIEGO GARCIA	NONE	HELO OFLY + REF MAP	+ LIMTD GRND DATA	DETAILED GROUND	
9 USMC-NORWAY	NONE	HELO OFLY + REF MAP	+ LIMTD GRND DATA	DETAILED GROUND	
10 RDJTF--12 SITES	NONE	12 SITES,ATTA	L2+ 1 FULL OHD TRANS	L2+ 4 LMTD OHD TRANS	
11 EMBASSY -- ANKARA	NONE	GRNDS,INTERIORS,ETC.	+HOSP,COMMS,HELO VWS	+ CLASSIFIED	
12 A/C CARRIER,VINSON	NONE	TRAVEL + DECK PLANS	+ CONSTRCTN	+ ELEV USE+MAINT	

MODEL STRUCTURE

Figure 3-7

SITE SELECTION

sites. The total cost of completing gold-plated versions of all twelve sites was 8,000 relative cost units or 616,000 dollars (approximately 70 dollars per cost unit).

Two cost constraints were placed on the site selection model, one at 350,000 dollars (100% of the estimated budget) and the other at 280,000 dollars (80% of the estimated budget). In addition, three different combinations of user and sizzle benefit weights were applied: (1) equal weights; (2) all sizzle; and (3) all user. The Design software described in Section 2.0 was then used to generate the most efficient site selection packages for the two cost constraints across all three sizzle/user weighting combinations. Table 3-4 presents a summary description of the efficient packages for a 350,000 dollar expenditure, across all three weighting combinations; Table 3-5 presents a similar summary description for a 280,000 dollar expenditure.

Figures 3-8 through 3-10 present the efficient curves for the equal-benefit weighting, the all-sizzle weighting, and the all-user weighting, respectively. Tables 3-6 through 3-8 describe the efficient packages for these three weighting conditions. A more detailed account of the twelve sites, rationale for the benefits and costs associated with these sites, and a summary table of the normalized benefits and costs are given in Appendix D.

A. Common Sites Across All Three Weighting Combinations

Selected Site	Cost (K)	Level
USMC--5 Oman sites	66.5	Detailed Ground, 1 site (4 of 4)
RDJTF--12 sites	21.0	Attache, Aerial, Maps, (3 of 4) and 1 Full Ohd Transf
CIA City	35.0	+Tourist Photography (4 of 4)
Fulda Gap	22.1	+Attache Photography (3 of 4)
29 Palms/USMC	20.0	Professional Film Crew (2 of 4)
A/C Carrier	42.0	+Construction Details (3 of 4)

B. Differences in Site Selection Across the Three Weighting Combinations

Selected Site	Equal Weights Cost (K)	Equal Weights Level	All Sizzle Cost (K)	All Sizzle Level	All User Cost (K)	All User Level
DOE Nuclear Reactor	49.0	+Ancillary Data (5 of 5)	0	None	49.0	+Ancillary Data (5 of 5)
Fulda Gap	Common Site		31.5	+Ancillary Data (4 of 4)	Common Site	
29 Palms/USMC	45.5	+March Exercise Remaster (4 of 4)	Common Site		45.5	+March Exercise Remaster (4 of 4)
A/C Carrier	52.5	+Elev Use +Maint Aid (4 of 4)	Common Site		52.5	+Elev Use +Maint Aid (4 of 4)
Embassy--Ankara	52.5	+Hosp, Comms, Helo Vws (3 of 4)	52.5	+Hosp, Comms, Helo Vws (3 of 4)	0	None
USMC--Egypt, Kenya, Somolia	0	None	70.0	Detailed Ground, 1 Site (4 of 4)	56.0	+Limited Ground Data (3 of 4)

Table 3-4

SITE SELECTION FOR A 350K EXPENDITURE

A. Common Sites Across All Three Weighting Combinations

Selected Site	Cost (K)	Level
USMC--5 Oman sites	66.5	Detailed Ground, 1 site (4 of 4)
RDJTF--12 sites	21.0	Attache, Aerial, Maps, (3 of 4) and 1 Full Ohd Transf
Fulda Gap	22.1	+Attache Photography (3 of 4)
CIA City	28.0	+Ancillary Data (3 of 4)
29 Palms/USMC	20.0	Professional Film Crew (2 of 4)
A/C Carrier	42.0	+Construction Details (3 of 4)

B. Differences in Site Selection Across the Three Weighting Combinations

Selected Site	Equal Weights Cost (K)	Equal Weights Level	All Sizzle Cost (K)	All Sizzle Level	All User Cost (K)	All User Level
DOE Nuclear Reactor	49.0	+Ancillary Data (5 of 5)	0	None	49.0	+Ancillary Data (5 of 5)
CIA City	35.0	+Tourist Photog (4 of 4)	35.0	+Tourist Photog (4 of 4)	Common Site	
29 Palms/USMC	45.5	+March Exercise Remaster (4 of 4)	Common Site		45.5	+March Exercise Remaster (4 of 4)
A/C Carrier	Common Site		Common Site		52.5	+Elev Use +Maint Aid (4 of 4)
Embassy--Ankara	0	None	52.5	+Hosp, Comms, Helo Vws (3 of 4)	0	None

Table 3-5

SITE SELECTION FOR A 280K EXPENDITURE

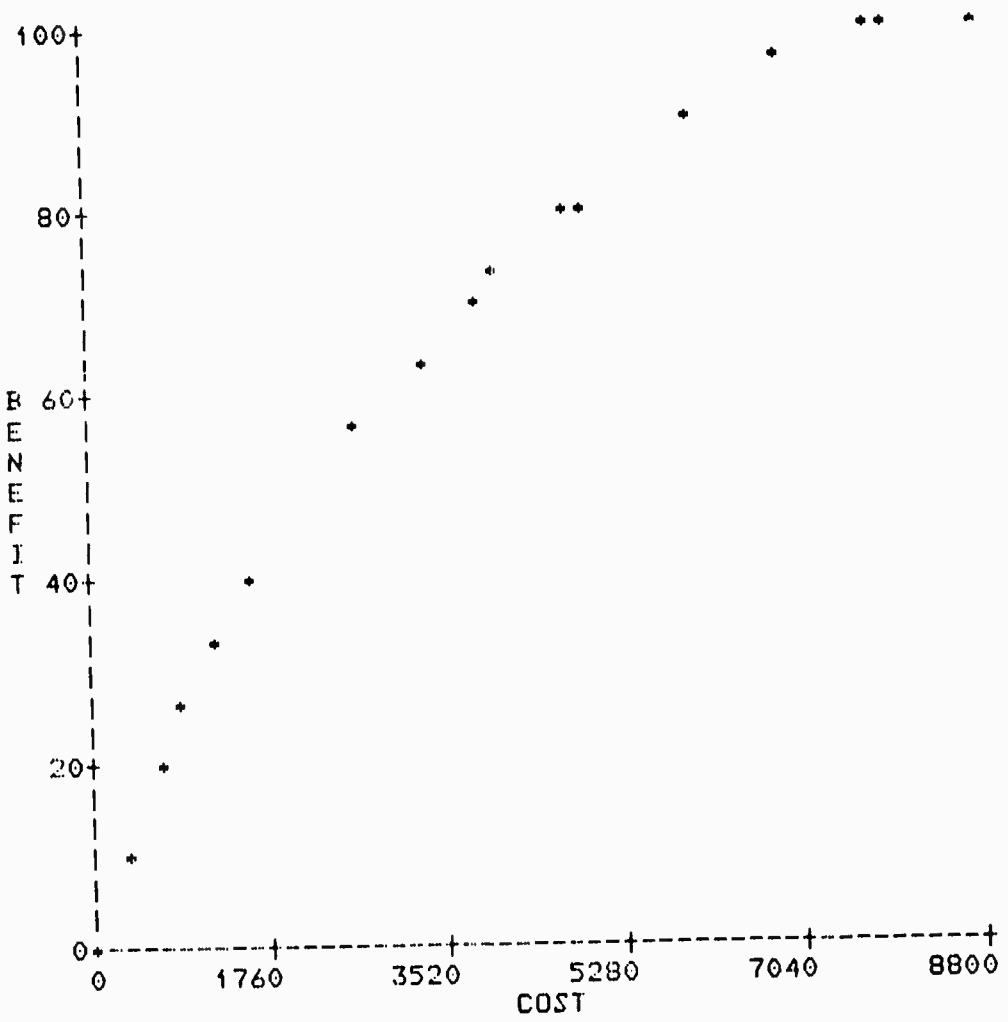

Figure 3-8

PLOT OF THE EFFICIENT PACKAGES IN THE
EQUAL-BENEFIT WEIGHTING OF THE SITE SELECTION MODEL

ALL VARIABLES SET AT LEVEL 1

BENEFIT	COST
0	0

CHANGE 4: CIA CITY
FROM 1: NONE
TO 2: CIA PHOTO + MAPS

BENEFIT	COST
198	649

CHANGE 3: FULDA GAP
FROM 1: NONE
TO 3: + ATTACHE PHOTOG.

BENEFIT	COST
335	1256

CHANGE 5: 29 PALMS/USMC
FROM 2: PROF. FILM CREW
TO 4: +MAR EXRCSE,REMASTER

BENEFIT	COST
407	1664

CHANGE 1: DOE NUCLEAR REACTOR
FROM 1: NONE
TO 5 + ANCILLARY DATA

BENEFIT	COST
643	3314

CHANGE 4 CIA CITY
FROM 3: + ANCILLARY DATA
TO 4 + TOURIST PHOTOG.

BENEFIT	COST
725	4014

CHANGE 12: A/C CARRIER,VINSON
FROM 3: + CONSTRCTN DETAILS
TO 4 + ELEV USE+MAINT AID

BENEFIT	COST
809	4914

CHANGE 3 FULDA GAP
FROM 3: + ATTACHE PHOTOG.
TO 4 + ANCILLARY DATA

BENEFIT	COST
899	6049

CHANGE 2: OLYMPIC SITE--LA
FROM 1: NONE
TO 4: + ANCILLARY DATA

BENEFIT	COST
987	7699

CHANGE 8: USMC-DIEGO GARCIA
FROM 1: NONE
TO 3: + LIMTD GRND DATA

BENEFIT	COST
1000	8714

CHANGE 10: RDJTF--12 SITES
FROM 1: NONE
TO 3: L2+ 1 FULL OHD TRANS

BENEFIT	COST
112	299

CHANGE 5: 29 PALMS/USMC
FROM 1: GRND/HELO(USMC)
TO 2: PROF. FILM CREW

BENEFIT	COST
265	941

CHANGE 4: CIA CITY
FROM 2: CIA PHOTO + MAPS
TO 3: + ANCILLARY DATA

BENEFIT	COST
346	1306

CHANGE 6: USMC-5 OMAN SITES
FROM 1: NONE
TO 4: DETAILED GRND,1 SITE

BENEFIT	COST
559	2614

CHANGE 12: A/C CARRIER,VINSON
FROM 1: NONE
TO 3 + CONSTRCTN DETAILS

BENEFIT	COST
714	3914

CHANGE 11 EMBASSY -- ANKARA
FROM 1: NONE
TO 3 +HOSP,COMMS,HELO VWS

BENEFIT	COST
796	4764

CHANGE 7 USMC-EGYPT,KENYA,SOM
FROM 1 NONE
TO 4 DETAILED GRND,1 SITE

BENEFIT	COST
889	5914

CHANGE 9: USMC-NORWAY
FROM 1: NONE
TO 4: DETAILED GROUND

BENEFIT	COST
955	6949

CHANGE 11: EMBASSY -- ANKARA
FROM 3: +HOSP,COMMS,HELO VWS
TO 4: + CLASSIFIED

BENEFIT	COST
992	7949

CHANGE 8: USMC-DIEGO GARCIA
FROM 3: + LIMTD GRND DATA
TO 4: DETAILED GROUND

BENEFIT	COST
1000	8799

Table 3-6

DESCRIPTIONS OF THE EFFICIENT PACKAGES IN THE EQUAL-BENEFIT WEIGHTING OF THE SITE SELECTION MODEL

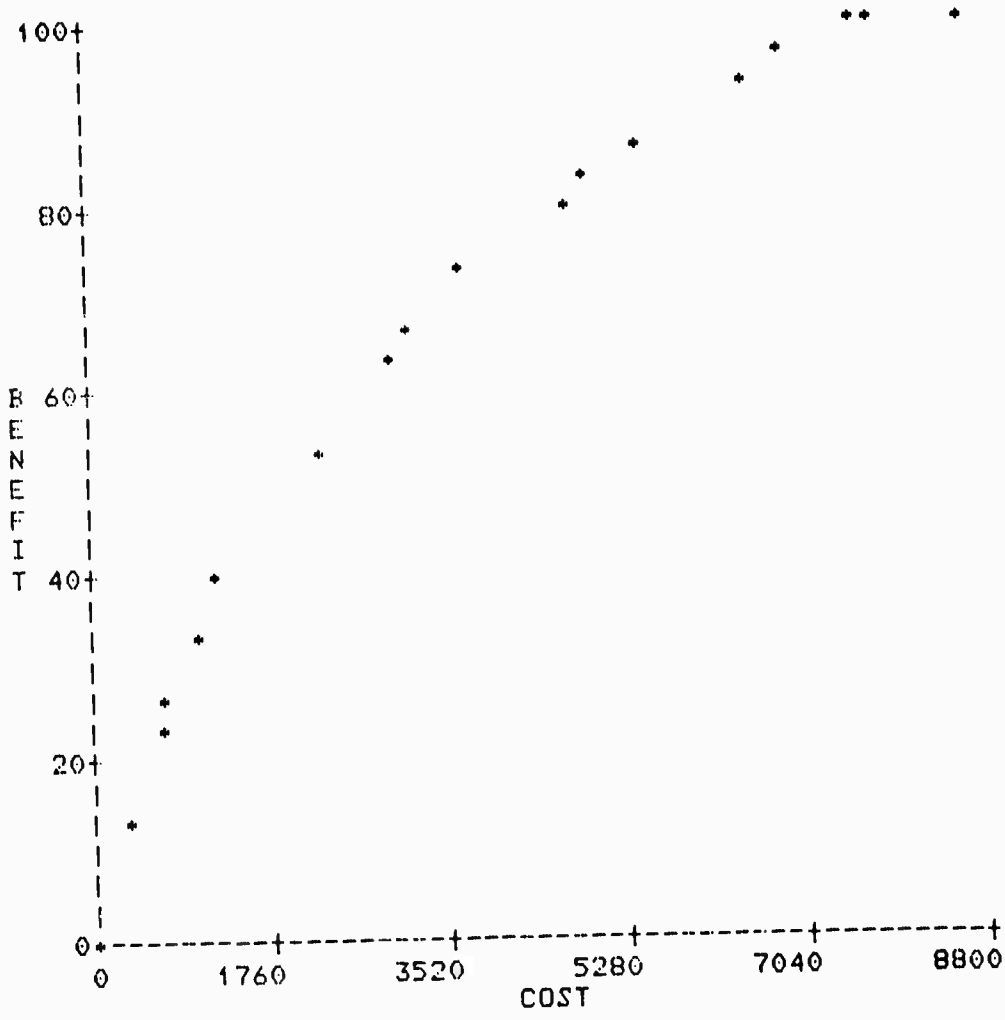

Figure 3-9

PLOT OF THE EFFICIENT PACKAGES IN THE ALL-SIZZLE WEIGHTING OF THE SITE SELECTION MODEL

```
ALL VARIABLES SET AT LEVEL 1
    BENEFIT       COST
        0          0


CHANGE  4: CIA CITY
   FROM 1: NONE
     TO 2: CIA PHOTO + MAPS

     BENEFIT       COST
       242          649

CHANGE  5: 29 PALMS/USMC
   FROM 1: GRND/HELO(USMC)
     TO 2: PROF. FILM CREW

     BENEFIT       COST
       327          991

CHANGE  6: USMC-5 OMAN SITES
   FROM 1  NONE
     TO 4  DETAILED GRND,1 SITE

     BENEFIT       COST
       540         2256

CHANGE  4  CIA CITY
   FROM 3  + ANCILLARY DATA
     TO 4  + TOURIST PHOTOG.

     BENEFIT       COST
       659         3106

CHANGE  7  USMC-EGYPT,KENYA,SOM
   FROM 1  NONE
     TO 4  DETAILED GRND,1 SITE

     BENEFIT       COST
       809         4706

CHANGE  1  DOE NUCLEAR REACTOR
   FROM 1: NONE
     TO 5  + ANCILLARY DATA

     BENEFIT       COST
       872         5541

CHANGE  5  29 PALMS/USMC
   FROM 2: PROF. FILM CREW
     TO 4: +MAR EXRCSE,REMASTER

     BENEFIT       COST
       957         6799

CHANGE 11: EMBASSY -- ANKARA
   FROM 3  +HOSP,COMMS,HELO VWS
     TO 4  + CLASSIFIED

     BENEFIT       COST
       993         7799

CHANGE  8: USMC-DIEGO GARCIA
   FROM 3: + LIMTD GRND DATA
     TO 4: DETAILED GROUND

     BENEFIT       COST
      1000         8649

CHANGE 10: RDJTF--12 SITES
   FROM 1: NONE
     TO 3: L2+ 1 FULL OHD TRANS

     BENEFIT       COST
       134          299

CHANGE  4: CIA CITY
   FROM 2: CIA PHOTO + MAPS
     TO 3: + ANCILLARY DATA

     BENEFIT       COST
       255          699

CHANGE  3: FULDA GAP
   FROM 1: NONE
     TO 3: + ATTACHE PHOTOG.

     BENEFIT       COST
       390         1306

CHANGE 11: EMBASSY -- ANKARA
   FROM 1: NONE
     TO 3  +HOSP,COMMS,HELO VWS

     BENEFIT       COST
       646         3006

CHANGE 12: A/C CARRIER,VINSON
   FROM 1. NONE
     TO 3: + CONSTRCTN DETAILS

     BENEFIT       COST
       719         3706

CHANGE  3  FULDA GAP
   FROM 3  + ATTACHE PHOTOG.
     TO 4  + ANCILLARY DATA

     BENEFIT       COST
       820         4841

CHANGE  9: USMC-NORWAY
   FROM 1  NONE
     TO 4: DETAILED GROUND

     BENEFIT       COST
       939         6441

CHANGE  2: OLYMPIC SITE--LA
   FROM 1: NONE
     TO 4: + ANCILLARY DATA

     BENEFIT       COST
       987         7549

CHANGE  8: USMC-DIEGO GARCIA
   FROM 1: NONE
     TO 3: + LIMTD GRND DATA

     BENEFIT       COST
      1000         8564
```

Table 3-7

DESCRIPTIONS OF THE EFFICIENT PACKAGES IN THE ALL-SIZZLE WEIGHTING OF THE SITE SELECTION MODEL

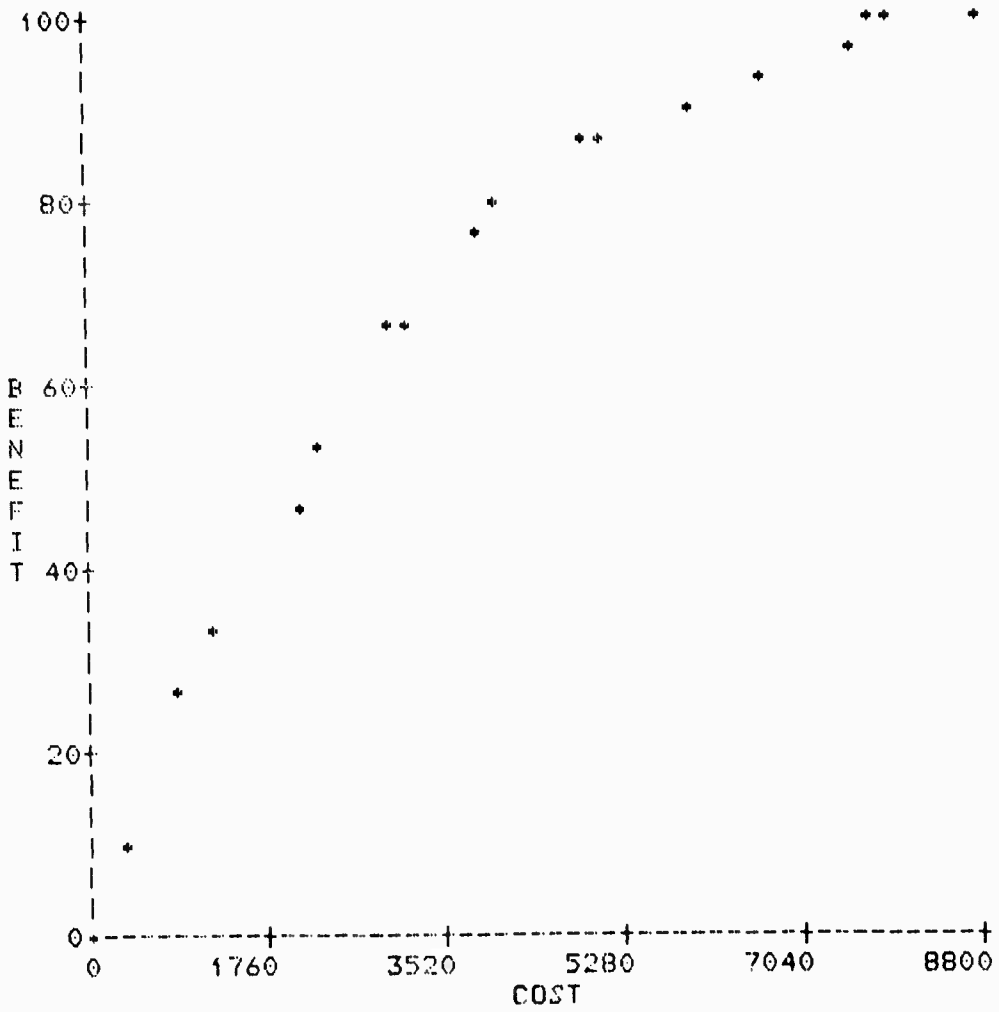

Figure 3-10

PLOT OF THE EFFICIENT PACKAGES IN THE ALL-USER WEIGHTING OF THE SITE SELECTION MODEL

ALL VARIABLES SET AT LEVEL 1

BENEFIT	COST
0	0

CHANGE 5: 29 PALMS/USMC
FROM 1: GRND/HELO(USMC)
TO 4: +MAR EXRCSE,REMASTER

BENEFIT	COST
259	949

CHANGE 6: USMC-5 OMAN SITES
FROM 1: NONE
TO 3: + LIMTD GRND DATA

BENEFIT	COST
476	2024

CHANGE 1: DOE NUCLEAR REACTOR
FROM 1: NONE
TO 5 + ANCILLARY DATA

BENEFIT	COST
659	3074

CHANGE 12: A/C CARRIER,VINSON
FROM 1 NONE
TO 4 + ELEV USE+MAINT AID

BENEFIT	COST
778	3874

CHANGE 7 USMC-EGYPT,KENYA,SOM
FROM 1 NONE
TO 3 + LIMTD GRND DATA

BENEFIT	COST
856	4864

CHANGE 3 FULDA GAP
FROM 3: + ATTACHE PHOTOG.
TO 4 + ANCILLARY DATA

BENEFIT	COST
872	5099

CHANGE 2: OLYMPIC SITE--LA
FROM 1: NONE
TO 4: + ANCILLARY DATA

BENEFIT	COST
950	6749

CHANGE 7: USMC-EGYPT,KENYA,SOM
FROM 3: + LIMTD GRND DATA
TO 4: DETAILED GRND,1 SITE

BENEFIT	COST
988	7699

CHANGE 8: USMC-DIEGO GARCIA
FROM 1: NONE
TO 3: + LIMTD GRND DATA

BENEFIT	COST
1000	8714

CHANGE 10: RDJTF--12 SITES
FROM 1: NONE
TO 3: L2+ 1 FULL OHD TRANS

BENEFIT	COST
86	299

CHANGE 3: FULDA GAP
FROM 1: NONE
TO 3 + ATTACHE PHOTOG.

BENEFIT	COST
336	1264

CHANGE 4: CIA CITY
FROM 1: NONE
TO 2: CIA PHOTO + MAPS

BENEFIT	COST
538	2374

CHANGE 4: CIA CITY
FROM 2: CIA PHOTO + MAPS
TO 3 + ANCILLARY DATA

BENEFIT	COST
666	3124

CHANGE 6: USMC-5 OMAN SITES
FROM 3: + LIMTD GRND DATA
TO 4 DETAILED GRND,1 SITE

BENEFIT	COST
794	4064

CHANGE 4 CIA CITY
FROM 3 + ANCILLARY DATA
TO 4 + TOURIST PHOTOG.

BENEFIT	COST
864	4964

CHANGE 9: USMC-NORWAY
FROM 1: NONE
TO 4: DETAILED GROUND

BENEFIT	COST
916	5999

CHANGE 11: EMBASSY -- ANKARA
FROM 1: NONE
TO 3: +HOSP,COMMS,HELO VWS

BENEFIT	COST
981	7499

CHANGE 11: EMBASSY -- ANKARA
FROM 3: +HOSP,COMMS,HELO VWS
TO 4: + CLASSIFIED

BENEFIT	COST
991	7949

CHANGE 8: USMC-DIEGO GARCIA
FROM 3: + LIMTD GRND DATA
TO 4: DETAILED GROUND

BENEFIT	COST
1000	8799

Table 3-8

DESCRIPTIONS OF THE EFFICIENT PACKAGES IN THE ALL-USER WEIGHTING OF THE SITE SELECTION MODEL

APPENDIX A

BENEFITS, COSTS, AND RATIONALE FOR THE SURROGATE TRAVEL MODEL

NORMALIZED VALUES

	VARIABLE	BENEFIT LEVEL 1	2	3	4	WEIGHT	COST LEVEL 1	2	3	4
1	CURRENT CAPABILITY	0	14	21		21	0	1	2	
2	TAKE ME THERE	0	66	82		82	0	115	144	
3	TRACE A PATH	0	82			82	0	108		
4	PUT ME THERE	0	23	93		93	0	60	120	
5	ATTACHE MODE	0	33	40	67	67	0	24	60	120
6	HELO FLIGHT	0	117	195		195	0	18	60	
7	WHAT'S HERE FDBACK	0	35	87		87	0	29	84	
8	PARALLEL UNIVERSES	0	77			77	0	72		
9	WHERE AM I?	0	109	186	219	219	0	58	77	96
10	RECORD/REPLAY	0	21			21	0	120		
11	UNDERWATER	0	57			57	0	72		

Table A-1

SUMMARY OF BENEFITS AND COSTS
FOR THE SURROGATE TRAVEL MODEL

VARIABLE 1 CURRENT CAPABILITY

CRITERION: USER

1	2	3
0	25	100

GENERAL DESCRIPTION

TWIRLS: THE CAPABILITY TO ROTATE IN AN ALMOST CONTINUOUS FASHION.

BACK AROUND CORNERS: (SELF-EXPLANATORY)

VARIABLE 2: TAKE ME THERE

CRITERION USER

1	2	3
0	[illegible]	100

GENERAL DESCRIPTION

EMBEDDED OPTION: THE SYSTEM TAKES THE USER TO A GIVEN PLACE IN A FIXED MANNER.

SEVERAL USER OPTIONS: THE USER SELECTS THE MANNER IN WHICH HE IS TAKEN TO A GIVEN PLACE.

Table A-2

RATIONALE FOR THE SURROGATE TRAVEL MODEL

VARIABLE 3: TRACE A PATH

CRITERION:	USER
1	2
0	10

GENERAL DESCRIPTION

SHOW ME ALL: THE USER MAY TRACE ANY PATH HE CHOOSES TO SEE.

VARIABLE 4: PUT ME THERE

CRITERION:		USER
1	2	3
0	25	100

GENERAL DESCRIPTION: THE USER INDICATES WHERE HE WISHES TO BE PLACED, AND THE SYSTEM PUTS HIM IN THAT PLACE. IT SHOULD BE NOTED THAT THE USER DOES NOT VISUALLY TRAVEL OVER THE PATH, BUT RATHER, HE IS AUTOMATICALLY PLACED IN THE SELECTED LOCATION.

SYMBOLIC: THE USER COMMUNICATES WITH THE SYSTEM IN A SYMBOLIC FASHION, e.g., BY TYPING IN THE INFORMATION.

POINT AT: (SELF-EXPLANATORY)

Table A-2 (Continued)

VARIABLE 5: ATTACHE MODE

CRITERION: USER

1	2	3	4
0	50	69	100

IMPORTANT, BUT THE AMOUNT OF THIS KIND OF DATA IS GOING TO BE SMALL. THIS IS IMPORTANT IN TERMS OF BEING USEFUL, BUT YOU CANNOT DO MUCH OF IT.

GENERAL DESCRIPTION: IMPLIES THE USE OF EXISTING PHOTOGRAPHY.

LEVEL 2 GIVES YOU A GRAPHIC INDEX OF YOUR LOCATION AND LEVEL 3 GIVES YOU FIELD OF VIEW INFORMATION.

Table A-2 (Continued)

VARIABLE 6: HELO FLIGHT	CRITERION. USER 1 2 3 0 60 100
GENERAL DESCRIPTION. HELO FLIGHT ALLOWS YOU TO TRAVEL VISUALLY IN HELICOPTER. LEVEL 1 ALLOWS FOR HELO TRAVEL IN ONE DIRECTION, LEVEL 2 ALLOWS FOR TRAVEL IN A TWO-DIMENSIONAL SPACE, AND LEVEL 3 ALLOWS FOR TRAVEL ALONG ALL THREE DIMENSIONS. HELO FLIGHT ALLOWS THE USER TO STEP BACK AND TAKE A LONG VIEW OF THE SITUATION, SOMETHING WHICH IS NOT POSSIBLE IN THE FIELD.	

Table A-2 (Continued)

VARIABLE 6. HELO FLIGHT

CRITERION: COST

LEVELS	COST
Y TRAVEL	0
X-Y TRAVEL	30
X-Y-Z TRAVEL	25

YOU SHOULD DISTINGUISH BETWEEN EXPLICIT TARGETS AND FLYING OVER.

IN PRACTICE, THERE REALLY IS NOT TOO MUCH Z TRAVEL. IF YOU GO TOO HIGH, YOU CANNOT SEE ANYTHING.

Table A-2 (Continued)

VARIABLE 7. WHAT'S HERE FDBACK

CRITERION: USER
1 2 3
0 40 100

GENERAL DESCRIPTION: ALLOWS THE USER TO SEE CRITICAL OBJECTS IN HIS GENERAL AREA.

LEVEL 2 ALLOWS FOR THE PRESENTATION OF A GRAPHICS DISPLAY ON A SECOND MONITER.

LEVEL 3 ALLOWS FOR THE INTEGRATION OF WHAT'S HERE INFORMATION INTO THE MAIN MONITER.

VARIABLE 7: WHAT'S HERE FDBACK

CRITERION. SIZZL
1 2 3
0 40 100

THIS HAS A GOOD DEAL OF SIZZLE. FOR INSTANCE, YOU COULD DISPLAY GHOST IMAGES OF TANKS IN THE AREA.

Table A-2 (Continued)

VARIABLE 8: PARALLEL UNIVERSES

CRITERION: USER

1 2

A 100

THERE ARE A NUMBER OF DIFFERENT REPRESENTATIONS OR PERSPECTIVES WE CAN PUT INTO THIS OPTION. FOR EXAMPLE, INFRARED REPRESENTATIONS, RADAR, VISUAL, OVERHEADS, AND SO ON.

THE CONCEPT MAY NOT BE BENEFICIAL FOR STRICT TRAVEL, BUT FOR HELO FLIGHT IT WOULD BE BENEFICIAL. IN MANY CASES, IT WOULD BE HIGHLY USEFUL TO HAVE A SUMMER VERSION AND A WINTER VERSION.

IN ANY CASE, SITE WOULD BE AN IMPORTANT CONSIDERATION.

IT SHOULD BE NOTED THAT THE EXPLICIT LINK METHOD IS NOT BAD FOR A SMALL AMOUNT OF MATERIAL, BUT IF YOU ARE DEALING WITH A GREAT DEAL OF INFORMATION, YOU MUST MOVE UP TO THE DATA BS LEVEL.

GENERAL DESCRIPTION: ALLOWS FOR ALTERNATE REPRESENTATIONS OF THE SAME AREA.

VARIABLE 8: PARALLEL UNIVERSES

CRITERION: SIZZL

1 2

C 100

THIS IS THE MOST IMPORTANT VARIABLE FOR SIZZLE. YOU COULD GO FROM A TOPOGRAPHICAL MAP TO RADAR TO ACTUAL VISUAL REPRESENTATIONS; YOU COULD ALTERNATE BETWEEN SUMMER AND WINTER AT A CERTAIN SITE, AND SO ON.

Table A-2 (Continued)

VARIABLE 9: WHERE AM I?

CRITERION:	USER
1	2	3	4
0	50	85	100

THIS IS IMPORTANT. IF YOU HAVE ALL THE HELO FLIGHT YOU WANT, BUT DO NOT KNOW WHERE YOU ARE, IT DOES NOT DO THE USER MUCH GOOD.

GENERAL DESCRIPTION: INDICATES THE LOCATION OF THE USER.

LEVELS 2 AND 3 SHOW THE USER'S LOCATION VIA A BLACK AND WHITE GRAPHICS DISPLAY, AND LEVEL 4 SHOW, LOCATION IN COLOR.

Table A-2 (Continued)

VARIABLE 10: RECORD/REPLAY

CRITERION: USER
1 2
0 100

THIS IS GOOD FOR THE GUY IN THE FIELD TO SHOW THE GENERAL WHAT WENT ON.

HOWEVER, IT IS GOOD NOT TO BE IN THE ROTF MODE FOR DEMONSTRATION PURPOSES.

YOU COULD ALWAYS HOOK UP A TV RECORDER AND TAPE THE WHOLE THING, INSTEAD OF DOING IT ON-LINE.

GENERAL DESCRIPTION: ALLOWS THE USER TO PLAY BACK PREVIOUS ACTIVITIES.

Table A-2 (Continued)

VARIABLE 11 UNDERWATER DESCRIPTION: USER
1 2
A 100

THERE ARE AVENUES ALONG WHICH YOU TRAVEL UNDERWATER. YOU WOULD TAKE CIRCUITOUS ROUTES TO AVOID DETECTION.

ORIENTATION AIDS WOULD BE VALUABLE TO CERTAIN SELECTED VIEWERS, BUT WOULD BE OF LIMITED VALUE OVERALL.

GREAT VALUE TO A FEW.

GENERAL DESCRIPTION: ALLOWS THE USER TO HAVE ORIENTATION AIDS WHILE TRAVELING UNDERWATER.

Table A-2 (Continued)

APPENDIX B

BENEFITS, COSTS, AND RATIONALE FOR THE DATA MODEL

NORMALIZED VALUES

	VARIABLE	BENEFIT LEVEL 1	2	3	4	WEIGHT	COST LEVEL 1	2	3	4
1	MAPPING	0	73	145		145	0	158	197	
2	MAP TO DATA	0	52	209		209	0	251	296	
3	SPECIAL EFFECTS	0	25			25	0	20		
4	OVERLAYS	0	81	122	163	163	0	63	79	158
5	SDMS ACCESS TO ST	0	43			43	0	49		
6	UPDATING DIGTAL INFO	0	181			181	0	232		
7	MICROFICHE ACCESS	0	183	204		204	0	2	20	
8	SOUND ACCESS	0	31			31	0	30		

Table B-1

SUMMARY OF THE BENEFITS AND
COSTS FOR THE DATA MODEL

VARIABLE 1: MAPPING

CRITERION: USER

1	2	3
0	50	100

GENERAL DESCRIPTION: ALLOWS THE USER TO TRANSPORT HIMSELF EXCLUSIVELY IN THE DOMAIN OF MAPS. LEVEL 2 ALLOWS THE USERTO MOVE FROM MAP TO MAP. LEVEL 3 ALLOWS THE USER TO MOVE UP AND DOWN AT WILL AND TO TRANSPORT HIMSELF ON A GLOBAL DIMENSION.

IN THE OVERALL CONTEXT, THIS IS IMPORTANT TO THE USER.

SURROGATE TRAVEL IS ONE DIMENSION FOR MOVING AROUND IN AN AREA, GOING FROM MAP TO MAP IS ANOTHER.

VARIABLE 1: MAPPING

CRITERION: SIZZL

1	2	3
0	50	100

THERE IS A CERTAIN AMOUNT OF SIZZLE IN GOING FROM MAP TO MAP.

"SIZZLE" IS THE POENTIAL FOR "DRAMATIC CHANGES."
SO, GLOBAL FLYABOUT HAS A GOOD DEAL OF SIZZLE.

Table B-2

RATIONALE FOR THE DATA MODEL

VARIABLE 2: MAP TO DATA

CRITERION: USER

1	2	3
0	25	100

CONTEXT REFERENCE SHOWS INFORMATION ABOUT AN AREA; IT DOES NOT PUT YOU IN THAT AREA. IT IS LIKE WHERE-AM-I.

VARIABLE 3: SPECIAL EFFECTS

CRITERION: USER

1	2
0	100

GENERAL DESCRIPTION: ALLOWS FOR SUCH SPECIAL EFFECTS AS INSERTS, FADING, AND SPLIT SCREEN IMAGES.

Table B-2 (Continued)

VARIABLE 4: OVERLAYS

CRITERION:	USER
1	2	3	4
0	50	75	100

GENERAL DESCRIPTION: ALLOWS ADDITIONAL MATERIAL TO BE SHOWN ALONG WITH THE PRIMARY DISPLAY.

NOTE: VERY IMPORTANT TO THE USERS.

VARIABLE 4: OVERLAYS

CRITERION:	SIZZL
1	2	3	4
0	50	75	100

WITH SUPER OVERLAYS, THIS COULD BE A MODERATELY HIGH SIZZLE ITEM. HOWEVER, "SUPER" OVERLAYS ARE DIFFICULT TO DEVELOP.

Table B-2 (Continued)

VARIABLE 5: SDMS ACCESS TO ST

CRITERION: USER

1	2
0	100

WITH RESPECT TO THE USERS, SDMS ACCESS REPRESENTS ONLY MARGINAL IMPROVEMENT OVER THE PRESENT SYSTEM.

Table B-2 (Continued)

VARIABLE 7: MICROFICHE ACCESS

CRITERION: USER

1	2	3
0	90	100

WE CANNOT EMPHASIZE THIS VARIABLE ENOUGH. THE USER MUST HAVE IT!

VARIABLE 7: MICROFICHE ACCESS

CRITERION: SIZZL

1	2	3
0	90	100

MICROFICHE ACCESS MIGHT EVEN BE A HINDRANCE. IT'S BULKY AND UNWIELDY.

THIS IS CERTAINLY NOT A SIZZLE ITEM.

Table B-2 (Continued)

VARIABLE 8: SOUND ACCESS

CRITERION: USER

1	2
0	100

HIGH SIZZLE, LOW USER BENEFIT.

HOWEVER, IT MAY BE SIMILAR TO THE IMPLEMENTATION OF THE TELEPHONE. WE REALLY DO NOT KNOW THE FULL RANGE OF ITS USES UNTIL WE EXERCISE IT.

VARIABLE 8: SOUND ACCESS

CRITERION: SIZZL

1	2
0	100

THIS IS A NEW DIMENSION. IT COULD BE EXCELLENT. THE POSSIBILITIES ARE UNEXPLORED.

Table B-2 (Continued)

APPENDIX C

BENEFITS, COSTS, AND RATIONALE FOR THE DELIVERY SYSTEM MODEL

NORMALIZED VALUES

	VARIABLE	BENEFIT LEVEL 1	2	3	4	5	WEIGHT	COST LEVEL 1	2	3	4	5
1	NUMBER OF MONITORS	0	133				133	0	15			
2	HARD COPY	0	36	43	71		71	0	11	15	53	
3	TELECONFERENCING	0	8	8	9		9	0	23	30	38	
4	PACKAGING	0	24	27	16		27	0	8	19	57	
5	NO. OF VD PLYRS/SYS	0	120	127	133		133	0	27	53	129	
6	MASS STORE + COMPUTR	0	19	62			62	0	23	53		
7	MICROFICHE SYSTEM	0	27	240	267		267	0	46	57	103	
8	POWER CONVERTERS	0	19	21	27		27	0	4	8	38	
9	TEMPEST	0	89				89	0	380			
10	GRAPHIC OVERLAYS	0	133				133	0	38			
11	INTERACTIVE MEANS	22	27	31	0	44	44	0	8	19	23	76
12	REMOTE SYSTEM ACCESS	0	4				4	0	19			

Table C-1

SUMMARY OF THE BENEFITS AND COSTS
FOR THE DELIVERY SYSTEM MODEL

VARIABLE 1: NUMBER OF MONITORS	CRITERION: USER 1 2 0 100

ONE MONITER PROBABLY IS NOT DESIRABLE. THE USER MAY WISH TO SWITCH BACK AND FORTH BETWEEN MONITERS.

YOU MAY WANT TO USE ONLY ONE MONITER FOR CONTROL AND USE THE OTHER MONITER ONLY FOR ADDITIONAL INFORMATION.

Table C-2

BENEFITS, COSTS, AND RATIONALE
FOR THE DELIVERY SYSTEM MODEL

VARIABLE 2: HARD COPY	CRITERION:	USER
	1 2 3	4
	0 50 60	100

COLOR:

ALTHOUGH THERE ARE PROBABLY THREE LEVELS OF COLOR (4X5 POLAROIDS, 8X10 POLAROIDS, AND XEROX GRAPHICS), IT IS UNREASONABLE EVEN TO CONSIDER THE LATTER TWO LEVELS OF COLOR BECAUSE OF THEIR HIGH COST.

PRO COLOR: YOU WILL WANT COLOR; FOR EXAMPLE, A MAP WITH GRAPHIC OVERLAYS. SOME OF THE MATERIAL IS COLOR CODED (MAPS).

ANTI COLOR: YOU CAN STILL SEE THE GRAPHICS; COLOR DOES NOT BUY YOU MUCH. FURTHER, WHEN DRAWING CIRCLES AND LINES ON THE HARDCOPY, IT WOULD BE FAR MORE EFFECTIVE TO HAVE 8X11 BLACK AND WHITE HARD COPY. WITH MAPS, COLOR IS IMPORTANT. BUT FOR THE REST OF THE DATA BASE, NO.

8X11 IS FAR BETTER SUITED TO PAPER. 4X5 TRANSPARENCIES ARE SLOW AND EXPENSIVE.

Table C-2 (Continued)

VARIABLE 5: NO. OF VD PLYRS/SYS

CRITERION:	USER
1	2	3	4
0	90	95	100

WITH ONE MONITER, YOU SACRIFICE SPEED, SMOOTHNESS, AND CONTINUITY.
YOU NEED TWO MONITERS!!

Table C-2 (Continued)

VARIABLE 7: MICROFICHE SYSTEM	CRITERION:			USER
	1	2	3	4
	0	10	90	100
MICROFICHE:				
POSITIVE: IT IS THE ONLY WAY YOU CAN UPDATE. IT IS NOT ALL THAT EXPENSIVE.				
NEGATIVE: IT IS DIFFICULT TO MAKE MICROFICHE.				

Table C-2 (Continued)

VARIABLE 11: INTERACTIVE MEANS

CRITERION:	1	2	3	4	USER 5
	50	60	70	0	100

TYPICALLY, USERS ARE QUITE HAPPY WITH A JOYSTICK PLUS 4 BUTTONS.

Table C-2 (Continued)

APPENDIX D

BENEFITS, COSTS, AND RATIONALE FOR THE SITE SELECTION MODEL

NORMALIZED VALUES

	VARIABLE	BENEFIT LEVEL 1	2	3	4	5	WEIGHT	COST LEVEL 1	2	3	4	5
1	DOE NUCLEAR REACTOR	0	53	64	71	84	84	0	60	64	68	80
2	OLYMPIC SITE--LA	0	19	26	32		32	0	64	68	85	
3	FULDA GAP	0	44	70	80		80	0	26	36	51	
4	CIA CITY	0	86	97	108		108	0	40	45	57	
5	29 PALMS/USMC	0	66	81	128		128	0	33	66	74	
6	USMC-5 OMAN SITES	0	76	121	152		152	0	76	86	108	
7	USMC-EGYPT,KENYA,SOM	0	40	62	80		80	0	80	91	114	
8	USMC-DIEGO GARCIA	0	1	8	8		8	0	77	87	97	
9	USMC-NORWAY	0	6	28	56		56	0	66	77	102	
10	RDJTF--12 SITES	0	26	112	94		112	0	32	34	34	
11	EMBASSY -- ANKARA	0	58	71	76		76	0	80	85	114	
12	A/C CARRIER,VINSON	0	57	71	84		84	0	60	68	85	

Table D-1

SUMMARY OF THE BENEFITS AND COSTS FOR THE EQUAL-BENEFITS WEIGHTING OF THE SITE SELECTION MODEL

NORMALIZED VALUES

	VARIABLE	BENEFIT LEVEL 1	2	3	4	5	WEIGHT	COST LEVEL 1	2	3	4	5
1	DOE NUCLEAR REACTOR	0	26	37	44	52	52	0	60	64	68	80
2	OLYMPIC SITE--LA	0	18	24	30		30	0	64	68	85	
3	FULDA GAP	0	37	63	75		75	0	26	36	51	
4	CIA CITY	0	107	121	134		134	0	40	45	57	
5	29 PALMS/USMC	0	72	54	90		90	0	33	66	74	
6	USMC-5 OMAN SITES	0	75	104	149		149	0	76	86	108	
7	USMC-EGYPT,KENYA,SOM	0	45	63	90		90	0	80	91	114	
8	USMC-DIEGO GARCIA	0	1	7	7		7	0	77	87	97	
9	USMC-NORWAY	0	7	34	67		67	0	66	77	102	
10	RDJTF--12 SITES	0	27	134	101		134	0	32	34	34	
11	EMBASSY -- ANKARA	0	84	106	112		112	0	80	85	114	
12	A/C CARRIER,VINSON	0	39	60	60		60	0	60	68	85	

Table D-2

SUMMARY OF THE BENEFITS AND COSTS FOR THE ALL-SIZZLE WEIGHTING OF THE SITE SELECTION MODEL

NORMALIZED VALUES

VARIABLE	BENEFIT LEVEL 1	2	3	4	5	WEIGHT	COST LEVEL 1	2	3	4	5
1 DOE NUCLEAR REACTOR	0	84	97	103	121	121	0	60	64	68	80
2 OLYMPIC SITE--LA	0	21	28	34		34	0	64	68	85	
3 FULDA GAP	0	52	78	86		86	0	26	36	51	
4 CIA CITY	0	62	70	78		78	0	40	45	57	
5 29 PALMS/USMC	0	60	112	172		172	0	33	66	74	
6 USMC-5 OMAN SITES	0	78	140	155		155	0	76	86	108	
7 USMC-EGYPT,KENYA,SOM	0	34	62	69		69	0	80	91	114	
8 USMC-DIEGO GARCIA	0	1	8	9		9	0	77	87	97	
9 USMC-NORWAY	0	4	22	43		43	0	66	77	102	
10 RDJTF--12 SITES	0	26	86	86		86	0	32	34	34	
11 EMBASSY -- ANKARA	0	28	31	34		34	0	80	85	114	
12 A/C CARRIER,VINSON	0	78	84	112		112	0	60	68	85	

Table D-3

SUMMARY OF THE BENEFITS AND COSTS FOR THE ALL-USER WEIGHTING OF THE SITE SELECTION MODEL

VARIABLE 11: INTERACTIVE MEANS

	CRITERION: SIZZL			
1	2	3	4	5
0	10	20	40	100

YOU SIMPLY CANNOT DO ENOUGH ON THIS VARIABLE. THIS AFFECTS THE QUALITY OF INTERACTION.

Table D-4

RATIONALE FOR THE SITE SELECTION MODEL

VARIABLE 1: DOE NUCLEAR REACTOR CRITERION: COST

LEVELS	COST	
NONE	0	
GROUND (INT + EXT)	525	
+ CONVENTIONAL MAPS	560	
+ LOW LEVEL HELO	595	THIS IS ASSUMING A HELO SUPPLIED BY OTHER PEOPLE.
+ ANCILLARY DATA	700	

Table D-4 (Continued)

VARIABLE 1: DOE NUCLEAR REACTOR	CRITERION:				USER
	1	2	3	4	5
	0	70	80	85	100
THE DATA WILL PRIMARILY INVOLVE INTERIORS, NOT EXTERIORS: TUNNELS, CORRIDERS,INGRESS, EGRESS, A LOT OF ANCILLARY DATA, E.G., A 150-PAGE MANUAL, AND POSSIBLY SOME SCHEMATICS ON PLUMBING AND WIRING.					
"CONVENTIONAL MAPS" INCLUDE MAPS AND BLUEPRINTS, BUT NOT PLUMBING AND WIRING, ETC.					
CLASSIFICATION PROBLEMS.					

Table D-4 (Continued)

VARIABLE 2: OLYMPIC SITE--LA CRITERION: COST

LEVELS	COST	
NONE	0	
GRND(INT/EXT TOTAL)	562	
+ LOW LEVEL HELO	600	
+ ANCILLARY DATA	750	A BIG GAP BETWEEN LEVEL THREE AND LEVEL FOUR.

Table D-4 (Continued)

VARIABLE 2: OLYMPIC SITE--LA	CRITERION:	USER
	1	4
	0	100

SIMILAR TO DOE REACTOR: DOES NOT INVOLVE PANORAMAS, BUT RATHER, INSIDES OF CRITICAL BUILDINGS, INGRESS, EGRESS, POWER LINES, PHONE LINES, A TACTICAL MAP, POSSIBLY BLUEPRINTS, FIELD-OF-VIEW--INSIDE LOOKING OUT (SAME AS THE EMBASSY).

Table D-4 (Continued)

VARIABLE 3: FULDA GAP CRITERION: COST

LEVELS	COST	
NONE	0	
MAPS	225	
+ ATTACHE PHOTOG.	315	
+ ANCILLARY DATA	450	THERE IS POSSIBLY A BIG PROBLEM WITH ANCILLARY DATA, ALTHOUGH MUCH OF IT IS ATTACHE.

Table D-4 (Continued)

VARIABLE 3: FULDA GAP

CRITERION:	USER
1	2	3	4
0	60	90	100

A GOOD DEAL OF EXISTING PHOTOGRAPHY, DETAILED TERRAIN MAPS. THIS WOULD BE ESPECIALLY GOOD FOR ATTACHE. HOWEVER, THERE WOULD NOT BE MUCH SURROGATE TRAVEL.

Table D-4 (Continued)

VARIABLE 4: CIA CITY CRITERION: COST

LEVELS	COST
NONE	0
CIA PHOTO + MAPS	350
+ ANCILLARY DATA	400
+ TOURIST PHOTOG.	500

ASSUME THAT CIA DOES THE PHOTOGRAPHY AND THE MAPS AND ITC DOES THE ATTACHE/TOURIST PHOTOGRAPHY, ADDING A RICHER PHOTO BASE--BEYOND WHAT THE CIA DOES.

Table D-4 (Continued)

VARIABLE 4: CIA CITY

CRITERION:	1	2	3	USER 4
	0	80	90	100

THIS WOULD BE USED PRIMARILY FOR TRAINING AGENTS.

NOTE THAT WITH CIA CITY, ITC WOULD TRAIN THE CIA ON PHOTOGRAPHY AND THEY WOULD THEN DO THEIR OWN FILMING.

CLASSIFICATION PROBLEMS.

Table D-4 (Continued)

VARIABLE 5: 29 PALMS/USMC CRITERION: COST

LEVELS	COST	
GRND/HELO(USMC)	0	
PROF. FILM CREW	292	
+MAR EXRCSE,DEL MSTR	585	
+MAR EXRCSE,REMASTER	650	THIS LEVEL IMPLIES MASTERING A SECOND DISK, AND YOU RE-INCUR ALMOST ALL THE COSTS BY GOING BACK OUT THERE, EVEN IF IT'S ONLY FIVE MINUTES WORTH ON THE DISK.

Table D-4 (Continued)

VARIABLE 5: 29 PALMS/USMC

CRITERION:	1	2	3	USER 4
	0	35	65	100

MOST PREFERRED SITE.

NOTE THAT TO DELAY THE FILMING OF 29 PALMS TWO MONTHS MIGHT ACTUALLY DELAY THE CONSTRUCTION OF THE DISC FOR MORE THAN TWO MONTHS.

Table D-4 (Continued)

VARIABLE 6. USMC-5 OMAN SITES CRITERION: COST

LEVELS	COST	
NONE	0	
HELO OFLY + REF MAP	665	ASSUMED TO BE PROVIDED.
+ LIMTD GRND DATA	760	CONTAINS ANCILLARY DATA.
DETAILED GRND,1 SITE	950	DETAILED GROUND FOR ONLY ONE OF THE FIVE SITES.

Table D-4 (Continued)

VARIABLE 7: USMC-EGYPT,KENYA,SOM CRITERION: COST

LEVELS	COST	
NONE	0	
HELO OFLY + REF MAP	700	PROVIDED BY OTHERS.
+ LIMTD GRND DATA	800	
DETAILED GRND,1 SITE	1000	

Table D-4 (Continued)

VARIABLE 8: USMC-DIEGO GARCIA CRITERION: COST

LEVELS	COST	
NONE	0	
HELO OFLY + REF MAP	680	PROVIDED BY OTHERS.
+ LIMTD GRND DATA	765	
DETAILED GROUND	850	

Table D-4 (Continued)

VARIABLE 9: USMC-NORWAY CRITERION: C...

LEVELS	COST	
NONE	0	
HELO OFLY + REF MAP	585	PROVIDED BY OTHERS.
+ LIMTD GRND DATA	675	
DETAILED GROUND	900	

Table D-4 (Continued)

VARIABLE 10: RDJTF--12 SITES	CRITERION 1	2	3	USER 4
	0	30	100	100

NOTE THAT THE TIME TO PRODUCE ONE OVERHEAD TRANSFORMED PHOTO IS ON THE ORDER OF 24 HOURS.

Table D-4 (Continued)

VARIABLE 10: RDJTF--12 SITES CRITERION: COST

LEVELS	COST
NONE	0
12 SITES,ATTACHE	285
L2+ 1 FULL OHD TRANS	299
L2+ 4 LMTD OHD TRANS	300

IN GENERAL, THIS VARIABLE IS RELATIVELY INEXPENSIVE BECAUSE THERE IS A DEARTH OF DATA.

Table D-4 (Continued)